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(54) **REFRIGERANT COMPRESSOR**

(75) Inventors: **Jesper Valbjoern**, Kolding (DK); **Anders Jakob Madsen**, Nordberg (DK); **Kristoffer Riemann Hansen**, Broager (DK)

(73) Assignee: **Secop GmbH**, Flensburg (DE)

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***F04B 17/00*** (2006.01)
***F04B 35/00*** (2006.01)

(52) **U.S. Cl.** ..... **417/360**; 417/363

(58) **Field of Classification Search** ..... 62/508; 417/312, 360, 363, 415, 902, 570; 248/200, 248/220.21, 226.11
See application file for complete search history.

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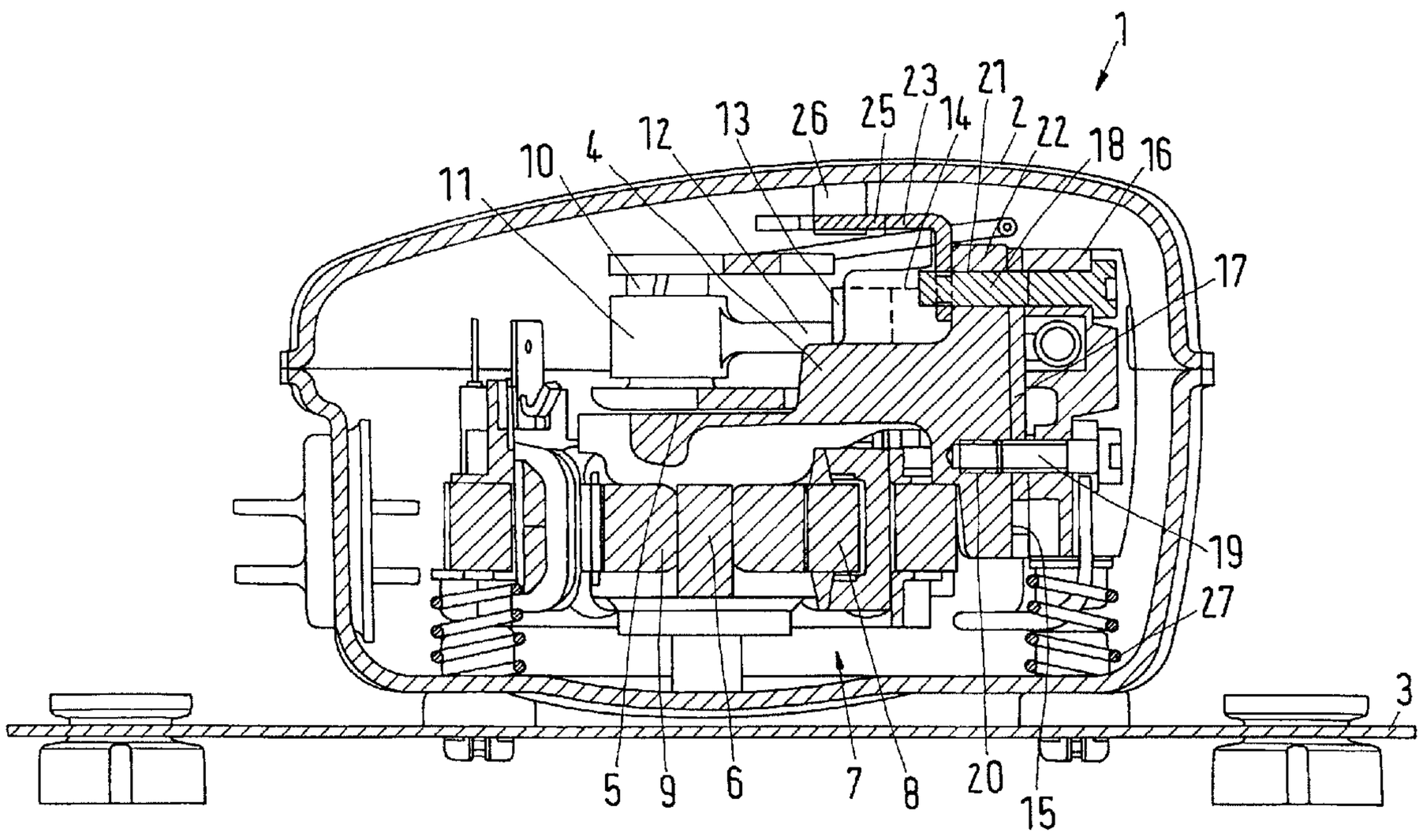
*Primary Examiner* — Devon C Kramer
*Assistant Examiner* — Bryan Lettman
(74) *Attorney, Agent, or Firm* — McCormick, Paulding & Huber LLP

(57) **ABSTRACT**

A refrigerant compressor (**1**) includes a cylinder block (**4**), in which a cylinder (**14**) is arranged, and a cylinder head (**16**), which covers the front side of the cylinder (**14**) and is connected to the cylinder block (**4**) by a plurality of threaded bolts (**18**, **19**). It is endeavored to achieve a good performance with a small mass of the refrigerant compressor. For this purpose, it is ensured that at least two threaded bolts (**18**) extend through the cylinder block (**4**) and are screwed into a common mating thread element (**23**) at the end projecting from the cylinder block (**4**).

**8 Claims, 1 Drawing Sheet**



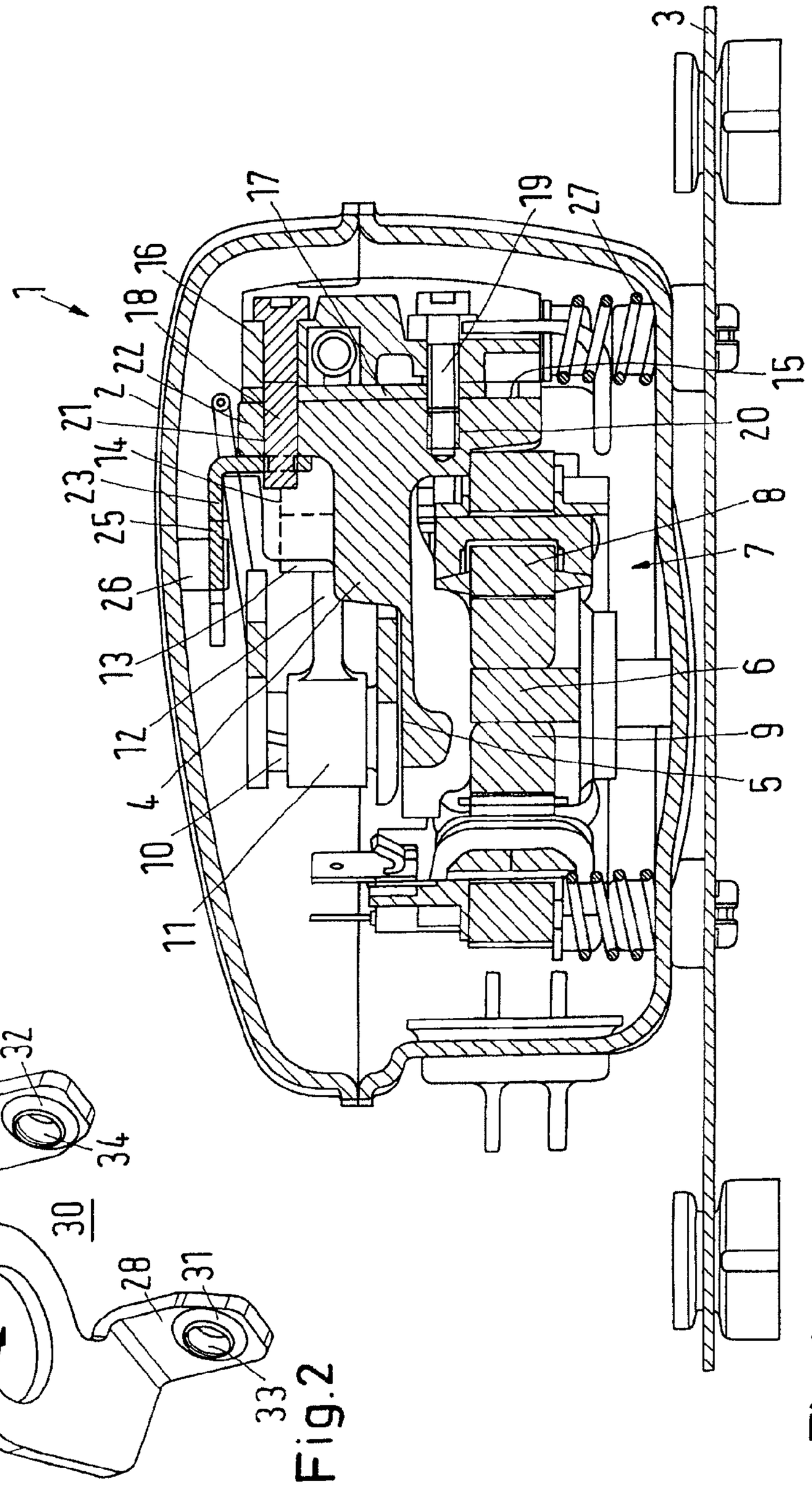

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Fig.1


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Fig.2

# REFRIGERANT COMPRESSOR

## CROSS REFERENCE TO RELATED APPLICATION

Applicant hereby claims foreign priority benefits under U.S.C. §119 from German Patent Application No. 10 2007 052 580.1 filed on Nov. 3, 2007, the contents of which are incorporated by reference herein.

## FIELD OF THE INVENTION

The invention concerns a refrigerant compressor with a cylinder block, in which a cylinder is arranged, and a cylinder head, which covers the front side of the cylinder and is connected to the cylinder block by means of threaded bolts.

## BACKGROUND OF THE INVENTION

Such a refrigerant compressor is, for example, known from DE 26 17 388 C3. In the cylinder is arranged a piston, which is reciprocated through a motor by means of a connecting rod drive. The cylinder block extends into a bearing unit for the crank shaft. The cylinder block comprises four threaded bores, the threaded bolts fixing the cylinder head to the cylinder block being screwed into said bores.

The machining of the cylinder block during manufacturing must ensure that the piston fits with the cylinder with relatively narrow tolerances. Accordingly, an accurate manufacturing of the cylinder bore is required. Also with a very accurate manufacturing of the cylinder, however, the manufacturing of the threaded bores in the cylinder block may again cause deformations of the cylinder, which may harm the tightness of the bearing of the piston in the cylinder and thus the efficiency of the compressor. In order to remedy this problem, the cylinder block must have a relatively massive design, which makes the manufacturing of the compressor expensive, and at the same time the compressor has a large mass, which makes it heavy during transportation.

## SUMMARY OF THE INVENTION

The invention is based on the task of providing a refrigerant compressor, which achieves a good efficiency with a smaller mass.

With a refrigerant compressor as mentioned in the introduction, this task is solved in that at least two threaded bolts extend through the cylinder block and are screwed into a common mating thread element at the end projecting from the cylinder block.

With this embodiment, at least two of the cylinder bolts will no longer require threaded bores in the cylinder block. On the contrary, through openings will be sufficient, which will, in many cases, not even require machining. Therefore, these openings can, for example, be made during moulding. As the threaded bolts extend through the cylinder block, they must have a relatively large length. The larger length of the threaded bolts causes an improved elasticity. Accordingly, a smaller tightening torque is required to fix the cylinder head reliably and tightly to the cylinder block. This again reduces the risk that the cylinder block is deformed and forms a leakage in relation to the piston. The mating thread element, which is common for several threaded bolts, simplifies the assembly. The threaded bolts no longer require individual threaded nuts to be retained at the rear of the cylinder block until the threaded bolt has caught the thread during fixing. On the contrary, the mating thread element is already secured against rotation, when two threaded bolts have been inserted. This simplifies the assembly.



Preferably, the mating thread element has a recess, which interacts with a counterpiece that is arranged at a housing, in which the cylinder block is located. The mating thread element then serves a second purpose. Usually, the cylinder block is movably supported in the housing on springs or the like, to avoid an oscillation transfer from the cylinder block to the housing and thus also to the outside. However, this support made it possible for the cylinder block or parts connected to it to hit against the housing during assembly of the refrigerant compressor in a refrigeration appliance or during transport of the refrigerant compressor or the refrigeration appliance. The mating thread element now offers an opportunity of preventing an excessively large movement of the cylinder block in relation to the housing. A movement of the cylinder block in the housing is only possible to the extent permitted by the mating thread element and the counterpiece. As soon as the mating thread element reaches the counterpiece, further movements are prevented.

Preferably, the recess is formed as a through opening. The counterpiece then projects through the through opening. Further, this embodiment has the advantage that during assembly the mating thread element can easily be retained at the recess, for example by means of a tightening pin.

Preferably, the recess is arranged at an angled area of the mating thread element. Thus, it is no longer necessary that the counterpiece interacting with the recess of the mating thread element extends in the same direction as the threaded bolt. The selection of the direction and the position of the counterpiece is more flexible.

Preferably, the mating thread element has a body and at least one threaded area with a larger thickness than the body. Basically, the only task of the body is to connect the threaded areas and, under certain circumstances, with the recess to form a movement direction for the cylinder block. Accordingly, it can be designed relatively weak. In order still to achieve a sufficient length for the inner thread, into which the threaded bolts are screwed, the area, in which the inner thread is arranged, the so-called threaded area, has a larger thickness. The larger thickness can be designed in different ways. Additional material can be added. The threaded area can be formed by a folding of the material of the body. The thickening can be formed by an upsetting. Regardless of the manufacturing method, this causes a sufficient engagement length of the threaded bolt in the mating thread element.

Preferably, two threaded areas are arranged in connectors, a free space being provided between the connectors. In this free space other elements of the compressor can then be arranged, for example a wall surrounding the cylinder, the wall being at the same time part of the cylinder block.

Preferably, a piston driven by a motor is arranged in the cylinder, and the mating thread element interacts with threaded bolts, which are located at the side of the cylinder facing away from the motor. In order to simplify the following explanation, the threaded bolts located at the side of the cylinder facing away from the motor are called “upper threaded bolts”, and the other threaded bolts are called “lower threaded bolts”. In the position, in which the lower threaded bolts are located, the cylinder block usually has sufficient material. Accordingly, here sufficient space is available for manufacturing the threaded bores for the lower threaded bolts, without risking a deformation of the cylinder. With the upper threaded bolts, it is different. Here, however, it will now be sufficient to provide a flange, through which the threaded bolts are guided.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention is described on the basis of a preferred embodiment in connection with the drawings, showing:

FIG. **1** is a schematic view of a longitudinal section through a refrigerant compressor; and

FIG. **2** is a perspective view of a mating thread element.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A refrigerant compressor **1** has a hermetically enclosed housing **2**, by means of which it can be built into a refrigeration appliance **3**.

A cylinder block **4** is arranged in the housing **2**. The cylinder block **4** forms a bearing **5** for a shaft **6** of a motor **7**, whose stator **8** is connected to the cylinder block **4**. A rotor **9** of the motor **7** is unrotatably connected to the shaft **6**. At its upper end, the shaft **6** has a crank pin **10**, on which a crank eye **11** of a connecting rod **12** is supported. The other end of the connecting rod **12** is connected to a piston **13** and converts the rotary movement of the shaft into a reciprocating movement of the piston **13**.

The piston **13** is arranged in a cylinder **14**, which is formed in the cylinder block **4**. Here, the cylinder **14** is drawn with dotted lines.

The cylinder block **4** has a front side **15**, at which a cylinder head **16** is arranged, which covers the cylinder **14**. A cylinder head sealing **17** is arranged between the cylinder head **16** and the cylinder block **4**. A valve plate with suction and pressure valves as well as a suction and pressure muffler, as known per se and not shown in detail, is arranged in the cylinder head **16**.

Via upper threaded bolts **18** and lower threaded bolts **19** the cylinder head **16** is connected to the cylinder block **4**. The term "upper threaded bolts" **18** covers the threaded bolts arranged at the side of the cylinder **14** facing away from the motor **7**. The "lower threaded bolts" **19** are the threaded bolts arranged at the side of the cylinder **14** facing the motor **7**.

The lower threaded bolts **19** are screwed into threaded bores **20**, which are formed in the cylinder block **4**. These threaded bores **20** have a relatively large distance to the cylinder **14**. Therefore, when making the threaded bores **20**, there is practically no risk that the cylinder **14** is deformed in the cylinder block **4**. Laterally to the drawing level, two threaded bores **20** and two lower threaded bolts **19** are arranged after each other, namely on both sides of an axis extending through the cylinder **14** in parallel to the drawing level.

The upper threaded bolts **18** are guided through openings **21**, which are formed in a flange **22** of the cylinder block **4** projecting from the cylinder **14**. These through openings **21** can already be made during the manufacturing of the cylinder, for example during moulding. A machining of the through bores **21** is possible, however, in many cases not needed.

In order to ensure that the upper threaded bolts **18** (also here, two upper threaded bolts **18** are arranged after each other laterally to the drawing level) can be used for fixing the cylinder head **16** to the cylinder block **4**, the two upper threaded bolts **18** are screwed into a mating thread element **23**. In FIG. **2**, the mating thread element **23** is shown in an enlarged view.



The mating thread element **23** has a body **24**, which can be made of sheet metal. The body **24** has a through opening **25**, by means of which it is guided across a counterpiece **26** that is fixed at the inside of the housing **2**. A movement of the cylinder block **4** in relation to the housing **2** therefore only possible until the edge of the through opening **25** of the mating thread element **23** hits the counterpiece **26**. Otherwise, a movement of the cylinder block **4** in relation to the housing **2** is made possible by means of springs **27**, with which the cylinder block **4** is supported in the housing **2**.

Two connectors **28**, **29** extend from the body in an angle. A free space **30** is formed between the two connectors **28**, **29**. In the free space **30** the area of the cylinder block **4** is located, in which the cylinder **14** is formed.

Each connector **28**, **29** has a threaded area **31**, **32**, which have a larger thickness than the body **24**. For example, the threaded area **31**, **32** is 1.5 to 2.5 times thicker than the body **24**. Each threaded area **31**, **32** comprises an inner thread **33**, **34**, into which a threaded bolt **18** is screwed. The fact that the threaded area **31**, **32** has an increased thickness ensures that a sufficient engagement length with the threaded bolt **18** is available.

The upper threaded bolts **18** are, as can be seen from FIG. **1**, longer than the lower threaded bolts **19**. Thus, the upper threaded bolts **18** have a larger flexibility than the lower threaded bolts **19**, and a smaller tightening torque is required to fix the cylinder head **16** to the cylinder block **4**. Accordingly, the risk of deforming the cylinder **14** during fixing of the cylinder head **16** is reduced.

As the risk of deforming the cylinder **14** is smaller, the amount of material required for the cylinder block **4** is reduced. Without loosing tightness and thus without reducing the efficiency, a cylinder block **4** with a relatively small mass can be formed.

While the present invention has been illustrated and described with respect to a particular embodiment thereof, it should be appreciated by those of ordinary skill in the art that various modifications to this invention may be made without departing from the spirit and scope of the present invention.

What is claimed is:

**1**. A refrigerant compressor comprising:
a housing with a counterpiece extending therefrom;
a cylinder block is movably supported within the housing;
a cylinder is arranged in the cylinder block; and
a cylinder head, which covers a front side of the cylinder and is connected to the cylinder block by means of a plurality of threaded bolts, wherein at least two of the plurality of threaded bolts extend through the cylinder block and are screwed into a common mating thread element at an end projecting from the cylinder block, the mating thread element has a recess to accept the counterpiece therein to allow movement of the cylinder block with respect to the housing.

**2**. The refrigerant compressor according to claim **1**, wherein the recess is formed as a through opening.

**3**. The refrigerant compressor according to claim **1**, wherein the recess is arranged at an angled area of the mating thread element.

**4**. The refrigerant compressor according to claim **1**, wherein the mating thread element has a body and at least one threaded area with a larger thickness than the body.

**5**. The refrigerant compressor according to claim **1**, wherein the mating thread element has two threaded areas arranged in connectors, a free space being provided between the connectors.

**6**. The refrigerant compressor according to claim **1**, wherein a piston driven by a motor is arranged in the cylinder, and the mating thread element interacts with the plurality of threaded bolts, which are located at a side of the cylinder facing away from the motor.



**7**. The refrigerant compressor according to claim **1**, wherein the recess is oversized to reduce transmission of vibrations from the cylinder block to the housing.

**8**. The refrigerant compressor according to claim **1**, wherein the cylinder block is supported within the housing by at least one spring.

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